

Civil Engineers

(O*NET 17-2051.00)

Nature of the Work

Civil engineers design and supervise the construction of roads, buildings, airports, tunnels, dams, bridges, and water supply and sewage systems. Civil engineering, considered one of the oldest engineering disciplines, encompasses many specialties. The major specialties within civil engineering are structural, water resources, environmental, construction, transportation, and geotechnical engineering.

Many civil engineers hold supervisory or administrative positions, from supervisor of a construction site to city engineer. Others may work in design, construction, research, and teaching.

Employment

Civil engineers held about 232,000 jobs in 2000. A little over half were employed by firms providing engineering consulting services, primarily developing designs for new construction projects. Almost one third of the jobs were in Federal, State, and local government agencies. The construction and manufacturing industries accounted for most of the remaining employment. About 12,000 civil engineers were self-employed, many as consultants.

Civil engineers usually work near major industrial and commercial centers, often at construction sites. Some projects are situated

in remote areas or in foreign countries. In some jobs, civil engineers move from place to place to work on different projects.

Job Outlook

Employment of civil engineers is expected to increase about as fast as the average for all occupations through 2010. Spurred by general population growth and an expanding economy, more civil engineers will be needed to design and construct higher capacity transportation, water supply, pollution control systems, and large buildings and building complexes. They also will be needed to repair or replace existing roads, bridges, and other public structures. There may be additional opportunities within noncivil engineering firms, such as management consulting or computer services firms. In addition to job growth, openings will result from the need to replace civil engineers that transfer to other occupations or leave the labor force.

Because construction and related industries—including those providing design services—employ many civil engineers, employment opportunities will vary by geographic area and may decrease during economic slowdowns, when construction often is curtailed.

Earnings

Median annual earnings of civil engineers were \$55,740 in 2000. The middle 50 percent earned between \$45,150 and \$69,470. The lowest 10 percent earned less than \$37,430, and the highest 10 percent earned more than \$86,000. Median annual earnings in the industries employing the largest numbers of civil engineers in 2000 were:

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| Federal Government | \$63,530 |
| Heavy construction, except highway | 62,010 |
| Local government | 56,830 |
| State government | 54,630 |
| Engineering and architectural services | 54,550 |

According to a 2001 salary survey by the National Association of Colleges and Employers, bachelor's degree candidates in civil engineering received starting offers averaging \$40,616 a year, master's degree candidates received an average offer of \$44,080, and Ph.D. candidates were offered \$62,280 as an initial salary.

Sources of Additional Information

Further information about civil engineers can be obtained from:
➤ American Society of Civil Engineers, 1801 Alexander Bell Dr., Reston, VA 20191-4400. Internet: <http://www.asce.org>
(See introduction to the section on engineers for information on working conditions, training requirements, and other sources of additional information.)



Civil engineers check on construction sites and monitor progress.

Computer Hardware Engineers

(O*NET 17-2061.00)

Nature of the Work

Computer hardware engineers research, design, develop, and test computer hardware and supervise its manufacture and installation. Hardware refers to computer chips, circuit boards, computer systems, and related equipment such as keyboards, modems, and printers. (Computer software engineers—often simply called computer engineers—design and develop the software systems that control computers. These workers are covered elsewhere in the *Handbook*.) The work of computer hardware engineers is very similar to that of electronics engineers, but unlike electronics engineers, computer hardware engineers work with computers and computer-related



Computer hardware engineers work with circuit boards, computer chips, keyboards, modems, and scanners.

equipment exclusively. (See the statement on electrical and electronics engineers elsewhere in the *Handbook*.) In addition to design and development, computer hardware engineers may supervise the manufacturing and installation of computers and computer-related equipment. The rapid advances in computer technology are largely a result of the research, development, and design efforts of computer hardware engineers. To keep up with technology change, these engineers must continually update their knowledge.

Employment

The number of computer hardware engineers is relatively small compared with the number of other computer-related workers who work with software or computer applications. Computer hardware engineers held about 60,000 jobs in 2000. About 25 percent were employed in computer and data processing services. About 1 out of 10 worked in computer and office equipment manufacturing, but many also are employed in communications industries and engineering consulting firms.

Job Outlook

Computer hardware engineers are expected to have favorable job opportunities. Employment of computer hardware engineers is projected to increase faster than the average for all occupations through 2010, reflecting rapid employment growth in the computer and office equipment industry, which employs the greatest number of computer engineers. Consulting opportunities for computer hardware engineers should grow as businesses need help managing, upgrading, and customizing increasingly complex systems. Growth in embedded systems, a technology that uses computers to control other devices such as appliances or cell phones, also will increase the demand for computer hardware engineers. In addition to job openings arising from employment growth, other vacancies will result from the need to replace workers who move into managerial positions, transfer to other occupations, or leave the labor force.

Earnings

Median annual earnings of computer hardware engineers were \$67,300 in 2000. The middle 50 percent earned between \$52,960 and \$86,280. The lowest 10 percent earned less than \$42,620, and the highest 10 percent earned more than \$107,360. Median annual earnings in the industries employing the largest numbers of computer hardware engineers in 2000 were:

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|---|----------|
| Computer and office equipment | \$75,730 |
| Computer and data processing services | 69,490 |
| Electronic components and accessories | 67,800 |
| Telephone communication | 59,160 |

Starting salaries for computer engineers with a bachelor's degree can be significantly higher than salaries of bachelor's degree graduates in many other fields. According to the National Association of Colleges and Employers, starting salary offers in 2001 for bachelor's degree candidates in computer engineering averaged \$53,924 a year; master's degree candidates averaged \$58,026; and Ph.D. candidates averaged \$70,140.

Sources of Additional Information

For further information about computer hardware engineers, contact:

- IEEE Computer Society, 1730 Massachusetts Ave. NW., Washington, DC 20036-1992. Internet: <http://www.computer.org>

(See introduction to the section on engineers for information on working conditions, training requirements, and other sources of additional information.)

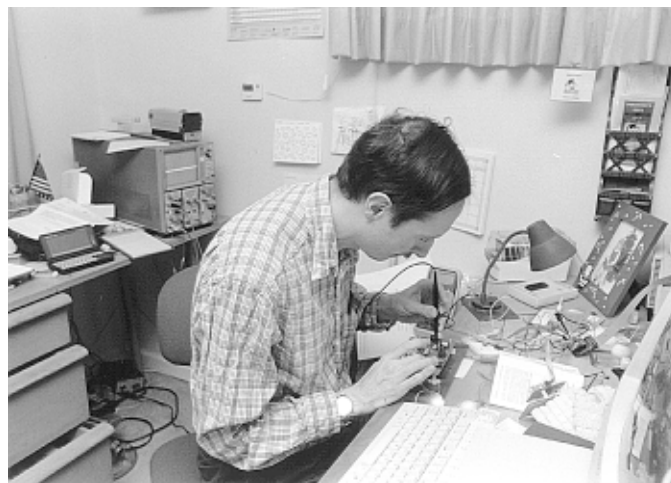
Electrical and Electronics Engineers

(O*NET 17-2071.00, 17-2072.00)

Nature of the Work

From geographical information systems that can continuously provide the location of a vehicle to giant electric power generators, electrical and electronics engineers are responsible for a wide range of technologies. Electrical and electronics engineers design, develop, test, and supervise the manufacture of electrical and electronic equipment. Some of this equipment includes power generating, controlling, and transmission devices used by electric utilities; and electric motors, machinery controls, lighting, and wiring in buildings, automobiles, aircraft, radar and navigation systems, and broadcast and communications systems. Many electrical and electronics engineers also work in areas closely related to computers. However, engineers whose work is related exclusively to computer hardware are considered computer hardware engineers, an occupation covered elsewhere in the *Handbook*.

Electrical and electronics engineers specialize in different areas such as power generation, transmission, and distribution; communications; and electrical equipment manufacturing, or a subdivision of these areas—industrial robot control systems or aviation



An electrical engineer working for a consulting firm looks for defective circuits.